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(54) **Data communications in a radio communication system**

Datenübertragung in einem Funkkommunikationssystem

Communication de données dans un système de radiocommunication

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Description

[0001] The present invention relates generally to the allocation of resources in a communication system in which packet data is communicated between a sending station and a receiving station. More particularly, the present invention relates to apparatus, and an associated method, for allocating communication channels for packet data communications with a mobile station in a multi-user, radio communication system, such as a cellular communication system which provides for packet data communications.

[0002] Advancements in digital telephony techniques have permitted the development, implementation, and widespread usage of multi-user, digital communication systems. Use of digital techniques is advantageous, inter alia, as the communication capacity of a digital communication system is typically greater than the capacity of a corresponding analog system. Error correction of signals transmitted during operation of such a system can also be improved.

[0003] A cellular communication system is exemplary of a communication system which has been made possible as a result of such advancements. A cellular communication system permits communications to be effectuated with a mobile station by way of a radio channel, thereby obviating the need for a wire line connection to form a communication channel between a sending and a receiving station, Through use of a cellular communication system, communications are possible at locations at which the use of fixed or hard-wired connections would be inconvenient or impractical, such as in a motor vehicle. Cellular communication systems have been implemented using various communication schemes. A CDMA (code-division, multiple-access) cellular communication system is an exemplary communication system, implemented utilizing code-division techniques.

[0004] Some cellular communication systems provide for the transmission of packet data to and from a mobile station. Information which is to be transmitted is formatted into discrete packets of data, and the packets are transmitted upon a communication channel. In a CDMA (code-division, multiple-access) communication scheme, for instance, a packet channel is assigned by allocation of a code, by which to encode packets of data which are to be transmitted by a transmitting station and to decode the packets, once received at a receiving station.

[0005] A dedicated channel, allocated to a user to communicate packet data thereon ensures ready access to the communication channel to communicate packet data thereon. As such ready access to the traffic channel necessitates allocation of the communication resources of the communication system, perhaps to the exclusion of other users, providing such ready access to a particular user is relatively resource consumptive.

[0006] Some packet data services are time-sensitive, while others are relatively time-insensitive. Packet-voice and packet-video services, e.g., are time-sensitive communication services. Ready access to the traffic channel upon which packet data is to be communicated is necessary to ensure timely delivery of the time-sensitive information. TC/IP communications, such as those utilized for web-browsing communications, are, conversely, relatively time-insensitive. Internet system resources need to be allocated in a manner which dedicates a channel to effectuate such communications. Allocation of a channel on an as-needed basis adequate to effectuate such communications. Another example can be found in document WO 97 47 112 (PHILIPS ELECTRONICS, 11 december 1997).

[0007] A communication system which selectively provides for ready access to communicate packet data by ensuring allocation of a dedicated channel for its communication, depending upon the packet service-type would therefore be advantageous.

[0008] It is in light of this background information related to packet communications, and communication systems permitting the communication of packet data, that the significant improvements of the present invention have evolved.

[0009] According to one aspect of the invention there is provided in a communication system having network infrastructure and a mobile station between which packet data communications pursuant to at least one packet service-type are selectively permitted by way of a communication channel, a QoS (quality of service) parameter associated with each of the at least one packet service-type, the QoS parameter defining a communication channel access-time delay-period within which access to the communication channel is to be provided to effectuate the packet data communications, an improvement of state apparatus for controlling operational states in which the mobile station is operable, said state apparatus comprising: an active state in which to operate the mobile station when packet data is to be communicated between the mobile station and the network infrastructure, a dedicated traffic channel assigned to form the communication channel to communicate the packet data thereon when the mobile station is operated in said active state; a control hold state into which a transition operation of the mobile station from said active state responsive to a first selected period of communication inactivity; and a virtual traffic substate into which a transition operation of the mobile station from said control hold state when the QoS parameter associated with the packet data service-type is beyond a selected level, the dedicated traffic channel being released out of assignation to form the communication channel.

[0010] According to a further aspect of the invention there is provided a method for operating a mobile station in a selected operational state, the mobile station forming a portion of a communication system and selectively permitted to communicate packet data pursuant to at least one packet service-typre with network infrastructure of the communication system, a QoS (quality of service)

parameter associated with each of the at least one packet service-type, the QoS parameter defining a communication channel access-time delay period within which access to the communication channel is to be provided to effectuate the packet data communications, said method comprising: transitioning operation of the mobile station into an active state when the packet data it to be communicated between the mobile station and the network infrastructure, a dedicated traffic channel assigned to form the communication channel to communicate the packet data thereon when the mobile station is operated in the active state; transitioning operation of the mobile station into a control hold state from the active state responsive to a first selected period of communication inactivity; and transitioning operation of the mobile station into a virtual traffic substate from the control hold state when the QoS parameter associated with the packet data service-type is beyond a selected level, the dedicated control channel released from assignation to form the communication channel.

[0011] The present invention, accordingly, advantageously provides apparatus, and an associated method, for allocating communication channels for packet data communications with a mobile station in a multi-user, radio communication system.

[0012] One or more packet service-types are provided by the communication system. A QoS (quality of service) parameter is associated with each of the packet data service-types such as a packet-voice communications service or a packet-video communications service. The QoS parameter defines allowable access-delay times for access to communication channels to communicate packet data pursuant to the data service type thereon. System resources are allocated responsive to the QoS parameter of the service subscription. If the service subscription provides a QoS parameter calling for ready access to a communication channel upon which to communicate the packet data, the communication channel is allocated to a mobile station, even during periods of communication inactivity. If, conversely, the QoS parameter of the service subscription does not call for ready access to the communication channel to communicate packet data thereon, during periods of communication inactivity, a communication channel is not caused to remain allocated to the mobile station.

[0013] State machine apparatus define operational states in which a data service is caused to be operated. Responsive to communication activity of a mobile station used to effectuate the data service and the QoS parameter of the service subscription, the mobile station is caused to be translated into other operational states and appropriate levels of system resources are caused to be allocated thereto.

[0014] The operational states or substate, in which the data service is caused to be operated is dependent upon the QoS parameter of the service. The amount of system resources allocated to the data service pursuant to the operational state in which a mobile station used to effectuate the data service is operated is dependent upon the QoS parameter. If the QoS parameter is of at least a selected value, the mobile station is operated in a state in which a channel remains allocated to the mobile station for packet data communications even subsequent to a period of communication inactivity by the mobile station. By continuing to allocate the channel to the mobile station, little or no access delay times occur when additional packet data is to be communicated.

[0015] An embodiment of the present invention forms a portion of a CDMA (code-division, multiple-access), cellular communication system, such as that constructed in compliance with the IS-95 interim standard, or a successor, promulgated by the EIA/TIA. Mobile stations operable in such a communication system are managed by way of a network control architecture having multiple numbers of states. State transitions are dependent upon communication activity of the mobile stations as well as the QoS parameters of the packet data service-types pursuant to which communications are to be effectuated. The value of the QoS parameter is determinative to which state a state transition is made. And, the state in which the mobile station, used to effectuate the data service, is operated is determinative of the level of resources allocated to the mobile station and, correspondingly, the access delay times within which a channel is made available for the communication of packet data thereon.

[0016] In these and other aspects, therefore, apparatus, and an associated method, controls operational states of a data service in which, e.g., a mobile station is operable to effectuate the data service. The data service is operable in a communication system having network infrastructure between which the mobile station is selectively permitted to communicate packet data pursuant to at least one packet service-type by way of a communication channel. A QoS (quality of service) parameter is associated with each packet service-type. The QoS parameter defines a communication channel access-time delay-period within which access to the communication channel is to be provided to effectuate the packet data communications. The data service is selectively operable in an active state when packet data is to be communicated between the mobile station and the network infrastructure, A dedicated traffic channel is assigned to form the communication channel to communicate the packet data thereon when the mobile station is operated in the active state. Operation of the data service after a period of inactivity elapses during which a dedicated channel is maintained is transitioned into a control hold state from the active state responsive to a first selected period of communication inactivity. Operation of the data service is transitioned into a virtual traffic substate from the control hold state when the QoS parameter associated with the packet data service-type is beyond a selected level and the dedicated traffic channel and control channel are released from assignation to form the communication channel. In a further embodiment, when the QoS parameter is within the selected level, the dedicated

control channel remains assigned to form the communication channel.

[0017] A more complete appreciation of the present invention and the scope thereof can be obtained from the accompanying drawings which are briefly summarized below, the following detailed description of the presently-preferred embodiments of the invention, and the appended claims.

[0018] Figure 1 illustrates a functional block diagram of an exemplary cellular communication system in which an embodiment of the present invention is operable.

[0019] Figure 2 illustrates a state diagram of control architecture of which an embodiment of the present invention forms a portion.

[0020] Figure 3 illustrates a state diagram of a portion of the control architecture of an embodiment of the present invention.

[0021] Figure 4 illustrates another state diagram which also forms a portion of the control architecture of an embodiment of the present invention.

[0022] Figure 5 illustrates a sequence diagram illustrating signal sequencing which occurs during operation of an embodiment of the present invention.

[0023] Figure 6 illustrates another sequence diagram also showing signal sequencing which occurs during operation of an embodiment of the present invention.

[0024] Figure 7 illustrates a method flow diagram listing the method steps of the method of operation of an embodiment of the present invention.

[0025] Referring first to Figure 1, a portion of an exemplary, cellular communication system, shown generally at 10, permits two-way, wireless communication with a mobile station 14. While, for purposes of illustration, only a single mobile station 14 is illustrated in the Figure, in an actual cellular communication system, a plurality of mobile stations are permitted to communicate concurrently to form a multi-user communications system. The communication system 10 is exemplary of a cellular communication system constructed pursuant to the specification proposed for the IS-95 3G interim standard; the communication system 10 is analogously representive of other radio communication systems capable of communicating packet data.

[0026] The communication system 10 includes network infrastructure, of which a portion is illustrated in the Figure. The infrastructure includes a plurality of BTSs (base stations) of which the BTS 16 is representative. The BTS 16 defines a cell 18 forming a coverage area in which down link communications 22 and reverse-link communications 24 are permitted with the mobile station 14 by way of radio air interface.

[0027] The BTS 16 is coupled to a BSC (base station controller) 26, and the BSC 26 is, in turn, coupled to a MSC (mobile switching center) 30. The MSC 30 is coupled to a PSTN (public-switched telephonic network) 32, thereby to permit communication between the mobile station 14 and a communication station, such as the station 34 coupled to the PSTN 32.

[0028] Packet data originated at, or to be terminated at, the mobile station 14 pursuant to a particular packet data service-type is transmitted upon a dedicated communication channel to permit the communication of packet data to and from the mobile station 14. System resources, e.g., the codes assigned in a CDMA system which define a dedicated channel, are limited. That is to say, the number of dedicated channels available to form radio links between mobile stations, such as the mobile station 14 and the network infrastructure is limited. Dedicated channels allocated for point-to-point, or other, communications with a large number of mobile stations might be of a number which prevents additional communications to be effectuated with additional mobile stations upon other dedicated channels. Subsequent at least to a period of communication inactivity by a mobile station, a channel assigned for such communication is typically reallocated to permit the effectuation of communications with other mobile stations.

[0029] When a communication channel is released from its allocation to a particular mobile station, there might be an access-delay time subsequent to a request by the mobile station to communicate additional packet data over the radio air interface, Such an access-time delay might be inappropriate if the communication of the packet data is time-sensitive.

[0030] If the communication channel were, however, to remain allocated to a mobile station even subsequent to periods of communication inactivity, there would be no access delay time necessitated to reallocate the channel to the mobile station when packet data subsequently is to be communicated between the mobile station and the network infrastructure. A QoS (quality of service) parameter representative of allowable access delay times in accessing a communication channel to effectuate the communication of packet data could be used to determine the allocation of resources to the mobile station in the communication system. The QoS parameter could form a portion of the subscription information associated with a packet data service-type stored at the subscription register 29 of the HLR 28. Such a scheme would permit improved levels of channel allocations to particular mobile stations based upon the value of the QoS parameter of the service subscription pursuant to which the mobile station is operable.

[0031] Figure 2 illustrates control architecture, shown generally at 44, which is represented by a state diagram. The control architecture 44 is representative of the MAC (medium access control) layer proposed for the IS-95 3G specification for providing packet data services for the communication of packet data originated at, or terminated at, a mobile station, such as the mobile station 14 shown in Figure 1. The control architecture 44 is implemented at the network infrastructure, e.g., at a base station, such as the BTS 16 (shown in Figure 1). The state diagram forming the control architecture 44 includes a plurality of states, here including a packet null state 46, an initialization state 48, a control hold state 52, an active

state 54, a suspended state 56, and a dormant state 58. The suspended state 56 further comprises a slotted suspended state.

[0032] Each of the states 46-58 define operational states in which a mobile station is operated with respect to packet services. The particular state in which the mobile station is operated is determinative of the level of connection in the packet service. When operated in the various ones of the operational states, different portions of the protocol stack of the control architecture are connected. For instance, a fully-connected mobile station is operated in the active state 54 whereat a PPP, a MAC layer, and physical layer connections are formed between the mobile station and the network infrastructure.

[0033] The state diagram representing the control architecture 44 further illustrates the state transitions between the various states 46-62. For instance, a transition, indicated by the line 64, is made between the packet null state 46 and the initialization state 48 when packet service is requested. And, a transition, indicated by the line 66 from the initialization state back to the packet null state occurs when packet service is deactivated. And, a transition, indicated by the line 68, occurs from the initialization state 48 to the control hold state 52 when a service option is connected. When this transition 68 is made, a dedicated signaling channel (DSCH) and a dedicated MAC channel (DMCH) are established.

[0034] A transition, indicated by the line 72 from the control hold state 52 to the active state 54 occurs when a dedicated traffic channel is established upon which to communicate packet data between the network infrastructure and the mobile station. A transition, indicated by the line 74 from the active state 54 back to the control hold state 52 occurs when a determination is made that data has not been exchanged for more than a selected time, here T_{active}.

[0035] A transition, indicated by the line 76 from the control hold state 52 to the suspended state 56 occurs when a determination is made of the absence of exchange of data for at least an additional, selected time period, here T_{hold}. When the transition is made, the DSCH and DMCH are released. A transition, indicated by the line 78 from the suspended state 56 back to the control hold state occurs when the dedicated MAC channel and the dedicated signaling channel are established. And, a transition, indicated by the line 82 from the suspended state 56 to the dormant state 58 occurs when a determination is made that user data is not exchanged for more than another time period, here indicated by $T_{suspend}$. A transition, indicated by the line 84 from the control hold state 52 to the dormant state 58 occurs when a release message transmission is sent between the mobile station and the network infrastructure, but PPP communications are not terminated.

[0036] A transition, indicated by the line 86 occurs from the dormant state 58 to the reconnect state 62 when determination is made that packet data is to be communicated between the mobile station and the network infrastructure. And, a transition, indicated by the line 88 from the dormant state 58 to the packet null state 46 occurs when the point-to-point communications are terminated and a release message indicative of such is transmitted. A transition, indicated by the line 92, from the control hold state 52 to the packet null state 46 also occurs when such a termination is made when the mobile station is operated in the control hold stage rather than the dormant state.

[0037] The operational states of the state diagram representing the control architecture 44 are categorized in two groups, depending upon the status of the packet service option, vis., the states are either "connected" states or "disconnected" states from a service option standpoint. The control hold states 52, the active state 54, and the suspended state 56 are all connected states. And, the remaining states, i.e., the packet null state 46, the initialization state 48, the dormant state 58, and the reconnect state 62 are all disconnected states.

[0038] By introducing a QoS parameter relating to allowable access time delay period within which assess to a communication channel must be provided to effectuate communication pursuant to a particular packet data service-type, the control architecture 44 can be modified to provide service responsive to the QoS parameter.

[0039] Figure 3 illustrates a portion of the control architecture 44, shown in Figure 2. Namely, the control hold state 52, the active state 54, and the suspended state 56 are again shown. And, the transitions indicated by the lines 72 and 74 from the control hold state 52 to the active state 54 and from the active state 54 back to the control hold state 52 respectively also are again shown. Figure 3 further illustrates a control hold normal substate 94 and a virtual traffic substate 96. As shown, the control hold normal substate 94 is a substate of the control hold state 52, and the virtual traffic substate is a substate of the suspended state 56. Here, a transition from the control hold state 52, or, more particularly, from the substate 94, to the virtual traffic substate 96 occurs when the mobile station is operated in the control hold state, but there is a period of communication inactivity corresponding to the time period T_{hold}. When the mobile station is operated in the control hold state, an extended assignment of dedicated channel resources is required. Such assignation increases the probability that the channel assignment might block the allocation of a channel to another mobile station. In an embodiment of the present invention, if the delay requirement of the QoS parameter is greater than a selected threshold t_{delay}, then once a data buffer of a mobile station is emptied, a transition from the control hold state 52 to the virtual traffic substate occurs. If communication inactivity continues, a transition from the virtual traffic substate to the suspended state 56 (shown in Figure 2) occurs, as indicated by the line 76. Such continued period of communication inactivity is times, e.g., by a virtual traffic timer.

[0040] Figure 4 also illustrates a portion of the control architecture 44 shown previously in Figure 2. Namely,

the control hold state 52 and the active state 54 are again shown. And, the transitions, indicated by the lines 72 and 74 are also again shown. Here, the control architecture is modified to include a control hold power save substate 102 in addition to the control hold normal substate 94. When the QoS parameter calls for ready access to a dedicated traffic channel, operation of a mobile station is transitioned from the control hold normal substate 94 to the control hold power save substate 102 for delay-sensitive communication applications. To ensure such ready access to the communication channel, the air interface resource must be maintainted. That is to say, allocation of the dedicated control channel to the mobile station must be maintained. So, a transition is not made to the virtual traffic substate 96 (shown in Figure 3). Continuous transmission on the reverse-link, dedicated control channel (DCCH) is not required so, when a transition, indicated by the line 104, from the control hold normal substate 94 to the control hold power save substate 102 occurs, the reverse DCCH is turned-off. When packet data is to be communicated upon the dedicated traffic channel and the mobile station is operated in the control hold power save substate, a transition, indicated by the line 106, is made. The dedicated control channel is maintained in a mode where the mobile station transmits and receives discontinuously (i.e., the radio frequency transmitter is turned on and off). Because the dedicated control channel is maintained, signaling required to obtain a dedicated traffic channel is minimal.

[0041] Figure 5 illustrates a sequence diagram 112 representing the signaling procedures between the mobile station 14 (shown in Figure 1) and the BTS 16 (also shown in Figure 1) when the mobile station is operated in the virtual traffic substate (shown in Figure 3) when a channel is to be accessed by the mobile station. First, and as indicated by the segment 114, the mobile station transmits a packet transaction request on the reverse control channel to the base station 16. The BTS 16 responds, as indicated by the segment 116 with a channel assignment message on a forward control channel. An optional, supplemental request message is returned, indicated by the segment 118 on a reverse-link dedicated control channel to the BTS 16, and, responsive thereto, a supplemental channel assignment is provided by the BTS 16 on the dedicated control channel to the mobile station 14.

Thereafter, and as indicated by the segments 124 and 126, data blocks formed of packet data are transmitted by the mobile station 14 and, if appropriate, also on a supplemental channel, to the BTS 16. As the packet transaction request, indicated by the segment 114 goes through a random access procedure, the delay in allocation of a channel to the mobile station upon which to transmit the data might be increased, depending upon the system load at the time the packet transaction request is generated.

[0042] Figure 6 illustrates a sequence diagram 132 representing the signaling procedures of a mobile station when the mobile station is operated in the control hold power save substate 102 (shown in Figure 4) when the mobile station is to access a dedicated channel. As noted above, when the mobile station is operated in the control hold power save substate, transmission on the reverse-link dedicated control channel is discontinuous.

[0043] First, and as indicated by the segment 132, a pilot-on signal is transmitted to the BTS 16. Responsive thereto, the base station 16 returns a wake-up response on the dedicated control channel to the mobile station. Thereafter, the mobile station generates a transaction request, indicated by the segment 138 on the reverse-link dedicated control channel, and the BTS 16 responds with a channel assignment on the dedicated control channel indicated by the segment 142. Optionally, a supplemental channel request, indicated by the segment 144 and a supplemental channel assignment, indicated by the segment 146, responsive thereto is provided to the mobile station.

[0044] Thereafter, and as indicated by the segment 148, a data block formed of packet data is generated by the mobile station on the fundamental channel assigned to the mobile station. And, if a supplemental channel assignment is given to the mobile station, additional data blocks are transmitted, indicated by the segment 152, on the supplementally-assigned channel. Because the transaction request, indicated by the segment 138, is transmitted upon a dedicated control channel without the need also first to transmit a packet transaction request pursuant to a random access procedure, delay access times are significantly reduced.

[0045] Figure 7 illustrates a method, shown generally at 162, of an embodiment of the present invention. The method controls a packet data service for a mobile station operating in a telecommunications system.

[0046] First, and as indicated by the block 164, the mobile station is operated in an active state. Then, and as indicated by the block 166, the mobile station is switched to a control hold state.

[0047] A determination is made, as indicated by the decision block 168, whether the packet data service has a quality of service requirement within a predetermined range. If so, the yes branch is taken to the block 172, and the mobile station is switched to a control hold power save substate. Otherwise, the no branch is taken from the decision block 168 to the block 174, and the mobile station is switched to a virtual traffic substate.

[0048] A manner is thereby provided by which to ensure that a channel remains allocated to a mobile station to communicate packet data thereon even subsequent to a period of communication inactivity, if a QoS parameter associated with a packet data service-type is of a selected value. Greater assurances are thereby provided that time sensitive data shall be timely communicated.

[0049] The previous descriptions are of preferred examples for implementing the invention and, the scope of the invention should not necessarily be limited by this description. The scope of the present invention is defined

by the following claims.

Claims

1. A state apparatus for use in a communication system (10) having network infrastructure and a mobile station (14) between which packet data communications pursuant to at least one packet service-type are selectively permitted by way of a communication channel, a quality of service parameter associated with each of the at least one packet service-type, the quality of service parameter defining a communication channel access-time delay-period within which access to the communication channel is to be provided to effectuate the packet data communications, an improvement of said state apparatus for controlling operational states in which the mobile station is operable, said state apparatus having:

   an active state (54) in which to operate the mobile station when packet data is to be communicated between the mobile station (14) and the network infrastructure, a dedicated traffic channel being assigned to form the communication channel to communicate the packet data thereon when the mobile station is operated in said active state (54);
   a control hold state (52) into which to transition operation of the mobile station (14) from said active state responsive to a first selected period of communication inactivity; and
   a virtual traffic substate (96) into which to transition operation of the mobile station (14) from said control hold state (52) when the quality of service parameter associated with the packet data service-type is beyond a selected level, the dedicated traffic channel being released out of assignation to form the communication channel when the mobile station is operated in said virtual traffic substate.

2. The state apparatus of claim 1 further comprising a control-hold power save substate (102) into which to transition operation of the mobile station (14) from said control hold state (52) when the quality of service parameter associated with the mobile station (14) is within the selected level.

3. The state apparatus of claims 1 or 2 further comprising a suspended state (56) into which to transition operation of the mobile station (14) from said virtual traffic substate (96) responsive to a second selected period of communication inactivity.

4. The state apparatus of claim 3 further comprising a virtual-traffic timer operable responsive to transitioning of operation of the mobile station (14) into said virtual traffic substate (96), said virtual-traffic timer for timing a timing period corresponding to the second selected period, operation of the mobile station (14) transitioning to said suspended state (56) subsequent to timing-out of said virtual-traffic timer.

5. The state apparatus of claims 3 or 4 wherein said suspended state (56) comprises a slotted suspended state.

6. The state apparatus of any preceding claim wherein, when the mobile station is operated in said control hold state (52), the dedicated traffic channel is released out of assignation to form the communication channel.

7. The state apparatus of any preceding claim wherein, when the mobile station (14) is in said active state (54), a (24) dedicated control channel is further assigned to form the communication channel between the mobile station (14) and the network infrastructure.

8. The state apparatus of claim 7 wherein, when the mobile station (14) is operated in said control hold state (52), the dedicated control channel remains assigned to form the communication channel between the mobile station (14) and the network infrastructure.

9. The state apparatus of claims 7 or 8 as dependent directly or indirectly on claim 2 wherein, when the mobile station (14) is operated in said control-hold power save substate (102), the reverse-link (24) dedicated control channel is operated in a discontinuous transmission mode.

10. The state apparatus of any preceding claim wherein, when the mobile station (14) is operated in said virtual traffic substate (96), the dedicated control channel is released out of assignation to form the communication channel.

11. The state apparatus of any preceding claim further comprising an activity timer operable responsive to operation of the mobile station (14) in the active state (54), said activity timer resettable during communication of packet data on the dedicated traffic channel, said activity timer for timing a timing period corresponding to the first selected period of communication inactivity, operation of the mobile station (14) transitioning to said control hold state (52) subsequent to timing-out of said activity timer.

12. The state apparatus of any preceding claim, wherein the communication system comprises a CDMA-cellular communication system and the state apparatus is a state machine that forms part of a cellular base

station of the network infrastructure and wherein said active state (54), said control hold state (52), and said virtual traffic substate (96) in which the mobile station (14) is operable comprise portions of the state machine.

13. The state apparatus of any preceding claim, wherein said quality of service parameter comprises a threshold delay for returning operation of the mobile station (14) to said active state (54).

14. The state apparatus of any preceding claim, wherein said threshold delay is compared against a predetermined value to determine if said quality of service parameter is beyond the selected level.

15. A method for operating a mobile station (14) in a selected operational state, the mobile station (14) forming a portion of a communication system and being selectively permitted to communicate packet data pursuant to at least one packet service-type with network infrastructure of the communication system by way of a communication channel, a quality of service parameter associated with each of the at least one packet service-type, the quality of service parameter defining a communication channel access-time delay period within which access to the communication channel is to be provided to effectuate the packet data communications, said method comprising:

transitioning operation of the mobile station (14) into an active state (54) when the packet data is to be communicated between the mobile station (14) and the network infrastructure, a dedicated traffic channel being assigned to form the communication channel to communicate the packet data thereon when the mobile station (14) is operated in the active state (54);

transitioning operation of the mobile station (14) into a control hold state (52) from the active state (54) responsive to a first selected period of communication inactivity; and

transitioning operation of the mobile station (14) into a virtual traffic substate (96) from the control hold state (52) when the quality of service parameter associated with the packet data service-type is beyond a selected level, the dedicated traffic channel being released from assignation to form the communication channel.

16. The method of claim 15 further comprising a step of transitioning operation of the mobile station (14) into a control-hold power save substate (102) from said control hold state (52) when the quality of service parameter associated with the mobile station (14) is within the selected level.

17. The method of claim 15 comprising the additional operation, alternate to said operation of transitioning operation of the mobile station (14) into the virtual traffic substate (96), of transitioning operation of the mobile station (14) to a control-hold power-save substate (102) within the control hold state (52) when the quality of service parameter associated with the packet data service-type is within the selected level.

18. The method of claim 17 comprising the additional operation, subsequent to said operation of transitioning operation of the mobile station (14) into the virtual traffic substate (96), when the mobile station (14) is to access the communication channel, of transitioning operation of the mobile station (14) back to the control hold state (52), and, thereafter back to the active state (54).

19. The method of any of claims 15 tao 18 wherein said step of transitioning operation of the mobile station (14) into the control hold state (52) comprises releasing the dedicated traffic channel.

20. The method of any of claims 15 to 19, wherein said step of transitioning operation of the mobile station into the active state comprises assigning a dedicated control channel to form the communication channel between the mobile station (14) and the network infrastructure.

21. The method of claim 20, wherein said step of transitioning operation of the mobile station (14) into the control hold state comprises maintaining the assignment of the dedicated control channel to form the communication channel between the mobile station (14) and the network infrastructure.

22. The method of claims 20 or 21 as dependent directly or indirectly on claim 16 wherein said step of transitioning the mobile station (14) into the control-hold power save substate (102) comprises operating the reverse-link (24) dedicated control channel in a discontinuous transmission mode.

23. The method of any of claims 20 to 22 wherein the step of transitioning operation of the mobile station (14) into the virtual traffic substate (96) comprises releasing the dedicated control channel.

24. The method of any of claims 15 to 23, wherein said quality of service parameter comprises a threshold delay for returning operation of the mobile station (14) to said active state (54).

25. The method of claim 24 further comprising the step of comparing said threshold delay against a predetermined value to determine if said quality of service parameter is beyond the selected level.

Patentansprüche

1. Zustandsvorrichtung zur Verwendung in einem Kommunikationssystem (10) mit einer Netzwerkinfrastruktur und einer Mobilstation (14), zwischen welchen Paketdatenkommunikationen entsprechend zumindest einer Paketdienstart mittels eines Kommunikationskanals wahlweise erlaubt werden, wobei ein Dienstgüteparameter mit jeder der zumindest einen Paketdienstart verknüpft ist, wobei der Dienstgüteparameter eine Kommunikationskanalzugriffszeitverzögerungsdauer definiert, in welcher ein Zugriff auf den Kommunikationskanal bereitzustellen ist, um die Paketdatenkommunikationen durchzuführen, mit einer Verbesserung der Zustandsvorrichtung zum Steuern von Betriebszuständen, in welchen die Mobilstation betriebsbereit ist, wobei die Zustandsvorrichtung besitzt:

   einen aktiven Zustand (54), in welchem die Mobilstation zu betreiben ist, wenn zwischen der Mobilstation (14) und der Netzwerkinfrastruktur Paketdaten zu übertragen sind, wobei ein dedizierter Verkehrskanal zugewiesen wird, um den Kommunikationskanal zu bilden, um die Paketdaten auf diesem zu übertragen, wenn die Mobilstation im aktiven Zustand (54) betrieben wird;
   einen Steuerung-halten-Zustand (52), in welchen ein Betrieb der Mobilstation (14) vom aktiven Zustand als Reaktion auf eine erste ausgewählte Dauer einer Kommunikationsinaktivität überzugehen hat; und
   einen Virtueller-Verkehr-Unterzustand (96), in welchen ein Betrieb der Mobilstation (14) vom Steuerung-halten-Zustand (52) überzugehen hat, wenn der mit der Paketdatendienstart verknüpfte Dienstgüteparameter jenseits eines ausgewählten Niveaus liegt, wobei der dedizierte Verkehrskanal aus einer Zuweisung, um den Kommunikationskanal zu bilden, freigegeben wird, wenn die Mobilstation im Virtueller-Verkehr-Unterzustand betrieben wird.

2. Zustandsvorrichtung gemäß Anspruch 1, weiter mit einem Steuerung-halten-Energiespar-Unterzustand (102), in welchen ein Betrieb der Mobilstation (14) vom Steuerung-halten-Zustand (52) überzugehen hat, wenn der mit der Mobilstation (14) verknüpfte Dienstgüteparameter innerhalb des ausgewählten Niveaus liegt ist.

3. Zustandsvorrichtung gemäß Anspruch 1 oder 2, weiter mit einem Unterbrechungszustand (56), in welchen ein Betrieb der Mobilstation (14) vom Virtueller-Verkehr-Unterzustand (96) als Reaktion auf eine zweite ausgewählte Dauer einer Kommunikationsinaktivität überzugehen hat.

4. Zustandsvorrichtung gemäß Anspruch 3, weiter mit einem Virtueller-Verkehr-Zeitgeber, der als Reaktion auf ein Übergehen eines Betriebs der Mobilstation (14) in den Virtueller-Verkehr-Unterzustand (96) betriebsbereit ist, wobei der Virtueller-Verkehr-Zeitgeber zum zeitlichen Steuern einer Zeitdauer entsprechend der zweiten ausgewählten Dauer dient, wobei ein Betrieb der Mobilstation (14) nach einem Zeitablauf des Virtueller-Verkehr-Zeitgebers in den Unterbrechungszustand (56) übergeht.

5. Zustandsvorrichtung gemäß Anspruch 3 oder 4, wobei der Unterbrechungszustand (56) einen geschützten Unterbrechungszustand aufweist.

6. Zustandsvorrichtung gemäß einem der vorstehenden Ansprüche, wobei der dedizierte Verkehrskanal aus einer Zuweisung, um den Kommunikationskanal zu bilden, freigegeben wird, wenn die Mobilstation im Steuerung-halten-Zustand (52) betrieben wird.

7. Zustandsvorrichtung gemäß einem der vorstehenden Ansprüche, wobei weiter ein dedizierter Steuerungskanal (24) zugewiesen wird, um den Kommunikationskanal zwischen der Mobilstation (14) und der Netzwerkinfrastruktur zu bilden, wenn die Mobilstation (14) im aktiven Zustand (54) ist.

8. Zustandsvorrichtung gemäß Anspruch 7, wobei der dedizierte Steuerungskanal zugewiesen bleibt, um den Kommunikationskanal zwischen der Mobilstation (14) und der Netzwerkinfrastruktur zu bilden, wenn die Mobilstation (14) im Steuerung-halten-Zustand (52) betrieben wird.

9. Zustandsvorrichtung gemäß Anspruch 7 oder 8, wenn direkt oder indirekt abhängig von Anspruch 2, wobei der dedizierte Rückwärtsstrecken-Steuerungskanal (24) in einer diskontinuierlichen Übertragungsbetriebsart betrieben wird, wenn die Mobilstation (14) in dem Steuerung-halten-Energiespar-Unterzustand (102) betrieben wird.

10. Zustandsvorrichtung gemäß einem der vorstehenden Ansprüche, wobei der dedizierte Steuerungskanal aus einer Zuweisung, um den Kommunikationskanal zu bilden, freigegeben wird, wenn die Mobilstation in dem Virtueller-Verkehr-Unterzustand (96) betrieben wird.

11. Zustandsvorrichtung gemäß einem der vorstehenden Ansprüche, weiter mit einem Aktivitätszeitgeber, der als Reaktion auf einen Betrieb der Mobilstation (14) im aktiven Zustand (54) betriebsbereit ist, wobei der Aktivitätszeitgeber während einer Kommunikation von Paketdaten auf dem dedizierten Verkehrskanal zurücksetzbar ist, wobei der Aktivitätszeitgeber zum zeitlichen Steuern einer Zeitdauer entspre-

chend der ersten ausgewählten Dauer einer Kommunikationsinaktivität dient, wobei ein Betrieb der Mobilstation (14) nach einem Ablaufen des Aktivitätszeitgebers in den Steuerung-halten-Zustand (52) übergeht.

12. Zustandsvorrichtung gemäß einem der vorstehenden Ansprüche, wobei das Kommunikationssystem ein zellulares CDMA-Kommunikationssystem aufweist und die Zustandsvorrichtung ein Zustandsautomat ist, der einen Teil einer zellularen Basisstation der Netzwerkinfrastruktur bildet, und wobei der aktive Zustand (54), der Steuerung-halten-Zustand (52) und der Virtueller-Verkehr-Unterzustand (96), in welchen die Mobilstation (14) betriebsbereit ist, Teile des Zustandsautomaten aufweisen.

13. Zustandsvorrichtung gemäß einem der vorstehenden Ansprüche, wobei der Dienstgüteparameter eine Schwellenwertverzögerung zum Zurückbringen eines Betriebs der Mobilstation (14) in den aktiven Zustand (54) aufweist.

14. Zustandsvorrichtung gemäß einem der vorstehenden Ansprüche, wobei die Schwellenwertverzögerung mit einem vorbestimmten Wert verglichen wird, um zu bestimmen, ob der Dienstgüteparameter jenseits des ausgewählten Niveaus liegt.

15. Verfahren zum Betreiben einer Mobilstation (14) in einem ausgewählten Betriebszustand, wobei die Mobilstation (14) einen Teil eines Kommunikationssystems bildet und ihr wahlweise erlaubt wird, Paketdaten entsprechend zumindest einer Paketdienstart mittels eines Kommunikationskanals mit einer Netzwerkinfrastruktur des Kommunikationssystems zu kommunizieren, wobei ein Dienstgüteparameter mit jeder der zumindest einen Paketdienstart verknüpft ist, wobei der Dienstgüteparameter eine Kommunikationskanalzugriffszeitverzögerungsdauer definiert, in welcher ein Zugriff auf den Kommunikationskanal bereitzustellen ist, um die Paketdatenkommunikationen durchzuführen, wobei das Verfahren aufweist:

Übergehen eines Betriebs der Mobilstation (14) in einen aktiven Zustand (54), wenn die Paketdaten zwischen der Mobilstation (14) und der Netzwerkinfrastruktur zu übertragen sind, wobei ein dedizierter Verkehrskanal zugewiesen wird, um den Kommunikationskanal zu bilden, um die Paketdaten auf diesem zu übertragen, wenn die Mobilstation (14) im aktiven Zustand (54) betrieben wird;

Übergehen eines Betriebs der Mobilstation (14) vom aktiven Zustand (54) in einen Steuerung-halten-Zustand (52) als Reaktion auf eine erste ausgewählte Dauer einer Kommunikationsinaktivität; und

Übergehen eines Betriebs der Mobilstation (14) vom Steuerung-halten-Zustand (52) in einen Virtueller-Verkehr-Unterzustand (96), wenn der mit der Paketdatendienstart verknüpfte Dienstgüteparameter jenseits eines ausgewählten Niveaus liegt, wobei der dedizierte Verkehrskanal aus einer Zuweisung, um den Kommunikationskanal zu bilden, freigegeben wird.

16. Verfahren gemäß Anspruch 15, weiter mit einem Schritt des Übergehens eines Betriebs der Mobilstation (14) vom Steuerung-halten-Zustand (52) in einen Steuerung-halten-Energiespar-Unterzustand (102), wenn der mit der Mobilstation (14) verknüpfte Dienstgüteparameter innerhalb des ausgewählten Niveaus liegt.

17. Verfahren gemäß Anspruch 15, mit dem zusätzlichen zu dem Betrieb des Übergehens eines Betriebs der Mobilstation (14) in den Virtueller-Verkehr-Zustand (96) alternativen Betrieb eines Übergehens eines Betriebs der Mobilstation (14) in einen Steuerung-halten-Energiespar-Unterzustand (102) innerhalb des Steuerung-halten-Zustands (52), wenn der mit der Paketdatendienstart verknüpfte Dienstgüteparameter innerhalb des ausgewählten Niveaus liegt.

18. Verfahren gemäß Anspruch 17 mit dem zusätzlichen auf den Betrieb eines Übergehens eines Betriebs der Mobilstation (14) in den Virtueller-Verkehr-Unterzustand (96), wenn die Mobilstation (14) auf den Kommunikationskanal zuzugreifen hat, folgenden Betrieb eines Übergehens eines Betriebs der Mobilstation (14) zurück in den Steuerung-halten-Zustand (52) und danach zurück in den aktiven Zustand (54).

19. Verfahren gemäß einem der Ansprüche 15 bis 18, wobei der Schritt eines Übergehens eines Betriebs der Mobilstation (14) in den Steuerung-halten-Zustand (52) ein Freigeben des dedizierten Verkehrskanals umfasst.

20. Verfahren gemäß einem der Ansprüche 15 bis 19, wobei der Schritt eines Übergehens eines Betriebs der Mobilstation in den aktiven Zustand ein Zuweisen eines dedizierten Steuerungskanal umfasst, um den Kommunikationskanal zwischen der Mobilstation (14) und der Netzwerkinfrastruktur zu bilden.

21. Verfahren gemäß Anspruch 20, wobei der Schritt eines Übergehens eines Betriebs der Mobilstation (14) in den Steuerung-halten-Zustand ein Beibehalten der Zuweisung des dedizierten Steuerungskanals umfasst, um den Kommunikationskanal zwischen der Mobilstation (14) und der Netzwerkinfrastruktur zu bilden.

22. Verfahren gemäß Anspruch 20 oder 21, wenn direkt oder indirekt abhängig von Anspruch 16, wobei der Schritt eines Übergehens der Mobilstation (14) in den Steuerung-halten-Energiespar-Unterzustand (102) ein Betreiben des dedizierten Rückwärtsstrekken-Steuerungskanals (24) in einer diskontinuierlichen Übertragungsbetriebsart umfasst.

23. Verfahren gemäß einem der Ansprüche 20 bis 22, wobei der Schritt eines Übergehens eines Betriebs der Mobilstation (14) in den Virtueller-Verkehr-Unterzustand (96) ein Freigeben des dedizierten Steuerungskanals umfasst.

24. Verfahren gemäß einem der Ansprüche 15 bis 23, wobei der Dienstgüteparameter eine Schwellenwertverzögerung zum Zurückbringen eines Betriebs der Mobilstation (14) in den aktiven Zustand (54) umfasst.

25. Verfahren gemäß Anspruch 24, weiter mit dem Schritt des Vergleichens der Schwellenwertverzögerung mit einem vorbestimmten Wert, um zu bestimmen, ob der Dienstgüteparameter jenseits des ausgewählten Niveaus liegt.

Revendications

1. Appareil d'état pour usage dans un système de communication (10) ayant une infrastructure réseau et une station mobile (14) entre lesquelles des communications de données en paquets conformes à au moins un type de service de données en paquets sont autorisées de manière sélective au moyen d'un canal de communication, un paramètre de qualité de service associé à chacun des au moins un type de service de données en paquets, le paramètre de qualité de service définissant une période de retard de temps d'accès au canal de communication à l'intérieur de laquelle l'accès au canal de communication doit être fourni afin de réaliser les communications de données en paquets, un perfectionnement dudit appareil d'état servant à contrôler des états de fonctionnement dans lesquels la station mobile peut fonctionner, ledit appareil d'état ayant :

   un état actif (54) dans lequel, afin que la station mobile puisse fonctionner quand des données en paquets doivent être communiquées entre la station mobile (14) et l'infrastructure réseau, un canal de trafic réservé est affecté pour former le canal de communication destiné à communiquer les données en paquets sur lui quand la station mobile fonctionne dans ledit état actif (54) ;
   un état de maintien de contrôle (52) dans lequel réaliser une opération de transition de la station mobile (14) à partir dudit état actif en réponse à une première période sélectionnée d'inactivité de communication ; et
   un sous-état de trafic virtuel (96) dans lequel réaliser une opération de transition de la station mobile (14) à partir dudit état de maintien de contrôle (52) quand le paramètre de qualité de service associé au type de service de données en paquets dépasse un niveau sélectionné, le canal de trafic réservé n'étant plus affecté pour former le canal de communication quand la station mobile fonctionne dans ledit sous-état de trafic virtuel.

2. Appareil d'état selon la revendication 1, comprenant en outre un sous-état d'économie de puissance en maintien de contrôle (102) dans lequel réaliser une opération de transition de la station mobile (14) à partir dudit état de maintien de contrôle (52) quand le paramètre de qualité de service associé à la station mobile (14) est conforme à un niveau sélectionné.

3. Appareil d'état selon la revendication 1 ou 2 comprenant en outre un état suspendu (56) dans lequel réaliser une opération de transition de la station mobile (14) à partir dudit sous-état de trafic virtuel (96) en réponse à une deuxième période sélectionnée d'inactivité de communication.

4. Appareil d'état selon la revendication 3 comprenant en outre un compteur de trafic virtuel qui fonctionne en réponse à la transition de fonctionnement de la station mobile (14) dans ledit sous-état de trafic virtuel (96), ledit compteur de trafic virtuel ayant pour fonction de calculer une période de temporisation correspondant à la deuxième période sélectionnée, le fonctionnement de la station mobile (14) passant audit état suspendu (56) à la suite de l'écoulement de la période de temporisation dudit compteur de trafic virtuel.

5. Appareil d'état selon la revendication 3 ou 4 dans lequel ledit état suspendu (56) comprend un état suspendu à segmentation temporelle.

6. Appareil d'état selon l'une quelconque des revendications précédentes dans lequel, quand la station mobile fonctionne dans ledit état de maintien de contrôle (52), le canal de trafic réservé n'est plus affecté pour former le canal de communication.

7. Appareil d'état selon l'une quelconque des revendications précédentes dans lequel, quand la station mobile (14) est dans ledit état actif (54), un canal de contrôle réservé (24) est affecté par ailleurs pour former le canal de communication entre la station mobile (14) et l'infrastructure réseau.

8. Appareil d'état selon la revendication 7 dans lequel, quand la station mobile (14) est dans ledit état de maintien de contrôle (52), le canal de contrôle réservé reste affecté pour former le canal de communication entre la station mobile (14) et l'infrastructure réseau.

9. Appareil d'état selon les revendications 7 ou 8 quand elles dépendent directement ou indirectement de la revendication 2 dans lequel, quand la station mobile (14) fonctionne dans ledit sous-état d'économie de puissance en maintien de contrôle (102), le canal de contrôle réservé en liaison inverse (24) fonctionne en mode de transmission discontinue.

10. Appareil d'état selon l'une quelconque des revendications précédentes dans lequel, quand la station mobile (14) fonctionne dans ledit sous-état de trafic virtuel (96), le canal de trafic réservé n'est plus affecté pour former le canal de communication.

11. Appareil d'état selon l'une quelconque des revendications précédentes comprenant en outre un compteur d'activité qui fonctionne en réponse au fonctionnement de la station mobile (14) dans l'état actif (54), ledit compteur d'activité pouvant être remis à zéro pendant la communication de données en paquets sur le canal de trafic réservé, ledit compteur d'activité ayant pour fonction de calculer une période de temporisation correspondant à la première période sélectionnée d'inactivité de communication, le fonctionnement de la station mobile (14) passant audit état de maintien de contrôle (52) à la suite de l'écoulement de la période de temporisation dudit compteur d'activité.

12. Appareil d'état selon l'une quelconque des revendications précédentes, dans lequel le système de communication comprend un système de communication cellulaire CDMA et l'appareil d'état est une machine d'état qui fait partie d'une station de base cellulaire de l'infrastructure réseau et dans lequel ledit état actif (54), ledit état de maintien de contrôle (52) et ledit sous-état de trafic virtuel (96) dans lequel la station mobile (14) peut fonctionner comprennent des portions de la machine d'état.

13. Appareil d'état selon l'une quelconque des revendications précédentes, dans lequel ledit paramètre de qualité de service comprend un retard de seuil servant à ramener le fonctionnement de la station mobile (14) audit état actif (54).

14. Appareil d'état selon l'une quelconque des revendications précédentes, dans lequel ledit retard de seuil est comparé à une valeur prédéterminée de façon à déterminer si ledit paramètre de qualité de service dépasse le niveau sélectionné.

15. Procédé de fonctionnement d'une station mobile (14) dans un état de fonctionnement sélectionné, la station mobile (14) faisant partie d'un système de communication et étant autorisée de manière sélective à communiquer des données en paquets conformes à au moins un type de service de données en paquets avec une infrastructure réseau du système de communication au moyen d'un canal de communication, un paramètre de qualité de service associé à chacun des au moins un type de service de données en paquets, le paramètre de qualité de service définissant une période de retard de temps d'accès au canal de communication à l'intérieur de laquelle l'accès au canal de communication doit être fourni afin de réaliser les communications de données en paquets, ledit procédé comprenant les étapes consistant à :

réaliser une opération de transition de la station mobile (14) dans un état actif (54) dans lequel, quand des données en paquets doivent être communiquées entre la station mobile (14) et l'infrastructure réseau, un canal de trafic réservé est affecté pour former le canal de communication destiné à communiquer les données en paquets sur lui quand la station mobile (14) fonctionne dans ledit état actif (54) ;
réaliser une opération de transition de la station mobile (14) dans un état de maintien de contrôle (52) à partir de l'état actif (54) en réponse à une première période sélectionnée d'inactivité de communication ; et
réaliser une opération de transition de la station mobile (14) dans un sous-état de trafic virtuel (96) à partir de l'état de maintien de contrôle (52) quand le paramètre de qualité de service associé au type de service de données en paquets dépasse un niveau sélectionné, le canal de trafic réservé n'étant plus affecté pour former le canal de communication.

16. Procédé la revendication 15, comprenant en outre une étape consistant à réaliser une opération de transition de la station mobile (14) dans un sous-état d'économie de puissance en maintien de contrôle (102) à partir dudit état de maintien de contrôle (52) quand le paramètre de qualité de service associé à la station mobile (14) est conforme au niveau sélectionné.

17. Procédé selon la revendication 15 comprenant l'opération supplémentaire, alternative par rapport à ladite opération de réalisation d'une transition de la station mobile (14) au sous-état de trafic virtuel (96), consistant à réaliser une opération de transition de la station mobile (14) à un sous-état d'économie de puissance en maintien de contrôle (102) à l'intérieur de l'état de maintien de contrôle (52) quand le para-

mètre de qualité de service associé au type de service de données en paquets est conforme au niveau sélectionné.

18. Procédé selon la revendication 17 comprenant l'opération supplémentaire, consécutive à ladite opération de réalisation d'une opération de transition de la station mobile (14) au sous-état de trafic virtuel (96), quand la station mobile (14) doit accéder au canal de communication, consistant à réaliser une opération de transition de la station mobile (14) en retour à l'état de maintien de contrôle (52), et, à nouveau en retour à l'état actif (54).

19. Procédé selon l'une quelconque des revendications 15 à 18 dans lequel ladite étape de réalisation d'une opération de transition de la station mobile (14) à l'état de maintien de contrôle (52) comprend l'étape consistant à libérer le canal de trafic réservé.

20. Procédé selon l'une quelconque des revendications 15 à 19, dans lequel ladite étape de réalisation d'une opération de transition de la station mobile à l'état actif comprend l'étape consistant à affecter un canal de contrôle réservé pour former le canal de communication entre la station mobile (14) et l'infrastructure réseau.

21. Procédé selon la revendication 20, dans lequel ladite étape de réalisation d'une opération de transition de la station mobile (14) à l'état de maintien de contrôle comprend l'étape consistant à maintenir l'affectation du canal de contrôle réservé pour former le canal de communication entre la station mobile (14) et l'infrastructure réseau.

22. Procédé selon l'une quelconque des revendications 20 ou 21 quand elles dépendent directement ou indirectement de la revendication 16 dans lequel ladite étape de réalisation d'une opération de transition de la station mobile (14) au sous-état d'économie de puissance en maintien de contrôle (102) comprend l'étape consistant à faire fonctionner le canal de contrôle réservé en liaison inverse (24) en mode de transmission discontinue.

23. Procédé selon l'une quelconque des revendications 20 à 22 dans lequel l'étape de réalisation d'une opération de transition de la station mobile (14) au sous-état de trafic virtuel (96) comprend l'étape consistant à libérer le canal de contrôle réservé.

24. Procédé selon l'une quelconque des revendications 15 à 23, dans lequel ledit paramètre de qualité de service comprend un retard de seuil servant à ramener le fonctionnement de la station mobile (15) audit état actif (54).

25. Procédé selon la revendication 24 comprenant en outre l'étape consistant à comparer ledit retard de seuil à une valeur prédéterminée de façon à déterminer si ledit paramètre de qualité de service dépasse le niveau sélectionné.

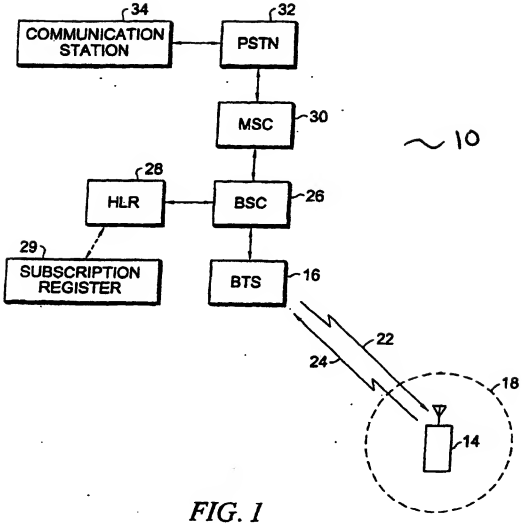
34
COMMUNICATION STATION
32
PSTN
MSC
30
10
28
HLR
BSC
26
29
SUBSCRIPTION REGISTER
BTS
16
22
24
18
14

FIG. 1

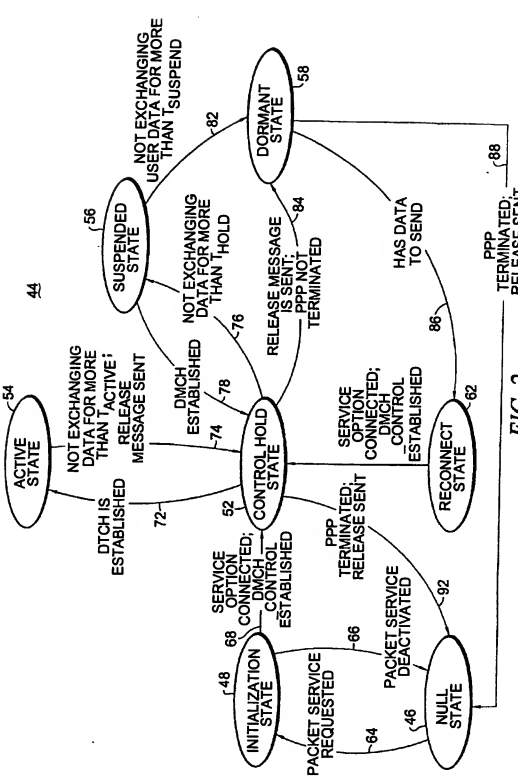
44
ACTIVE STATE
54
NOT EXCHANGING DATA FOR MORE THAN T_{ACTIVE}; RELEASE MESSAGE SENT
DTCH IS ESTABLISHED
72
CONTROL HOLD STATE
52
SUSPENDED STATE
56
NOT EXCHANGING DATA FOR MORE THAN T_{HOLD}
76
NOT EXCHANGING USER DATA FOR MORE THAN $T_{SUSPEND}$
82
DORMANT STATE
58
DMCH ESTABLISHED
74
78
RELEASE MESSAGE IS SENT; PPP NOT TERMINATED
84
HAS DATA TO SEND
86
RECONNECT STATE
62
SERVICE OPTION CONNECTED; DMCH CONTROL ESTABLISHED
INITIALIZATION STATE
48
68
SERVICE OPTION CONNECTED; DMCH CONTROL ESTABLISHED
PPP TERMINATED; RELEASE SENT
66
PACKET SERVICE REQUESTED
64
PACKET SERVICE DEACTIVATED
46
92
NULL STATE
PPP TERMINATED; RELEASE SENT
88

FIG. 2

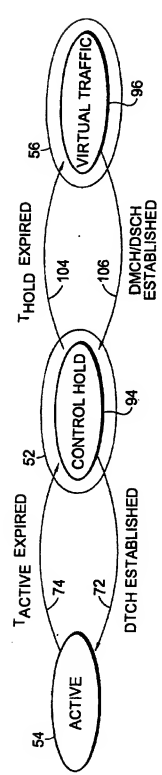
ACTIVE
54
T ACTIVE EXPIRED
74
72
DTCH ESTABLISHED
52
CONTROL HOLD
94
T HOLD EXPIRED
104
106
DMCH/DSCH ESTABLISHED
56
VIRTUAL TRAFFIC
96

FIG. 3

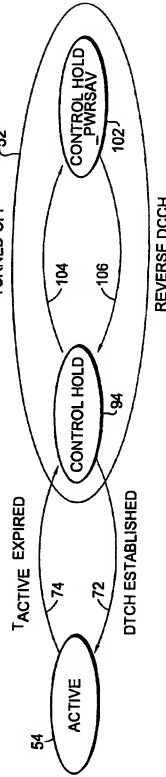
ACTIVE
54
T ACTIVE EXPIRED
74
72
DTCH ESTABLISHED
REVERSE DCCH TURNED OFF
52
CONTROL HOLD
94
104
106
CONTROL HOLD _PWRSAV
102
REVERSE DCCH TURNED ON

FIG. 4

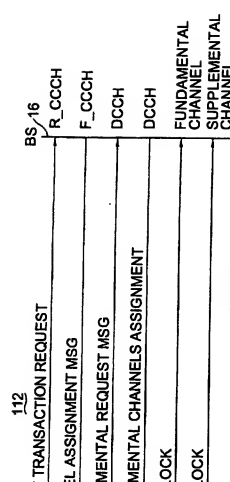
MS
112
BS 16
114 PACKET TRANSACTION REQUEST
R_CCCH
14
116 CHANNEL ASSIGNMENT MSG
F_CCCH
(OPTIONAL)
118 SUPPLEMENTAL REQUEST MSG
DCCH
122 SUPPLEMENTAL CHANNELS ASSIGNMENT
DCCH
124 DATA BLOCK
FUNDAMENTAL CHANNEL
126 DATA BLOCK
SUPPLEMENTAL CHANNEL

FIG. 5

MS
132
BS 16
134 PILOT ON
PILOT
14
136 WAKEUP RESPONSE
DCCH
138 TRANSACTION REQUEST
DCCH
(OPTIONAL)
142 CHANNEL ASSIGNMENT
DCCH
144 SUPPLEMENTAL CHANNEL REQUEST
DCCH
146 SUPPLEMENTAL CHANNELS ASSIGNMENT
DCCH
148 DATA BLOCK
FUNDAMENTAL CHANNEL
152 DATA BLOCK
SUPPLEMENTAL CHANNEL

FIG. 6

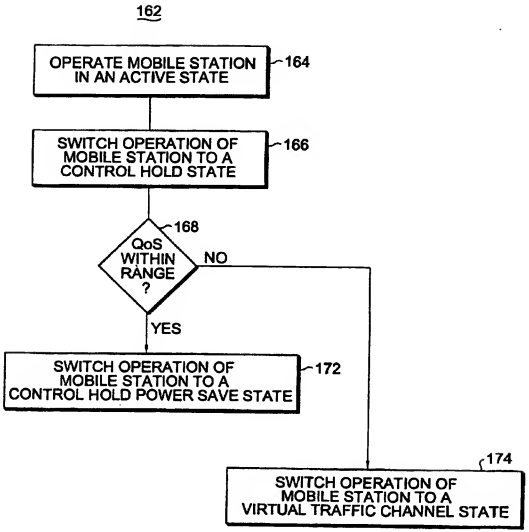
162
OPERATE MOBILE STATION IN AN ACTIVE STATE
164
SWITCH OPERATION OF MOBILE STATION TO A CONTROL HOLD STATE
166
168
QoS WITHIN RANGE ?
NO
YES
SWITCH OPERATION OF MOBILE STATION TO A CONTROL HOLD POWER SAVE STATE
172
174
SWITCH OPERATION OF MOBILE STATION TO A VIRTUAL TRAFFIC CHANNEL STATE

FIG. 7